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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/881,769	06/18/2001	Izuru Nakai	P21131	8245

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EXAMINER	
STAICOVICI, STEFAN	
ART UNIT	**PAPER NUMBER**
1732	

DATE MAILED: 01/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/881,769	NAKAI ET AL.	
	Examiner	Art Unit	
	Stefan Staicovici	1732	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 November 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 12-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-3* is/are allowed.

6)☒ Claim(s) *12-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicants' amendment filed November 10, 2004 has been entered. No claims have been amended. Claims 4-11 have been canceled. New claim 15 has been added. Claims 1-3 and 12-15 are pending in the instant application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ayrton (US Patent No. 5,741,456) in view of WO 86/02301 and in further view of Temple *et al.* (US Patent No. 6,228,311 B1).

Ayrton ('456) teaches the basic claimed process of drilling a hole in a multi-layered sheet using a laser without delamination of said multi-layered sheet occurring (see col. 2, line 53 through col. 3, line 18). It is submitted that since delamination is avoided, that the resulting inter-layer pull-off force is smaller than an inter-layer adhesion force.

Regarding claim 12, Ayrton ('456) does not teach a first low-powered laser pulse to drill said hole in said multi-layered sheet and a second high-powered pulse to trim said drilled hole.

WO 86/02301 teaches the claimed process of laser drilling a multi-layer sheet by providing a train of low-powered laser pulses to drill through said multi-layered sheet, said low powered pulses preventing delamination, and after said multi-layered sheet has been drilled, higher power pulses are employed. It is submitted that since delamination is avoided, that the resulting inter-layer pull-off force is smaller than an inter-layer adhesion force (see Abstract and page 6, line 4 through page 7, line 14). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a first train of low-powered laser pulses to drill a hole in a multilayered-sheet as taught by WO 86/02301 in the process of Ayrton ('456), because WO 86/02301 specifically teaches that low-powered laser pulses avoid delamination of said multi-layered sheet, whereas Ayrton ('456) teaches laser drilling in a multi-layered sheet while avoiding delamination of said multi-layered sheet, hence both references solving the similar problem of delamination of a multi-layered sheet while drilling holes therein.

Further regarding claim 12, although WO 86/02301 teaches a second train of higher power pulses, the process of Ayrton ('456) in view of WO 86/02301 does not teach trimming said drilled hole in a multi-layered sheet. Temple *et al.* ('311) teach laser drilling a hole in which the laser power is increased at the end of the drilling process in order to trim the final shape of said drilled hole (see col. 7, lines 1-11). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a second train of higher power pulses as taught by WO 86/02301 to trim said drilled hole as taught by Temple *et al.* ('311) in the process of Ayrton ('456) because, Temple *et al.* ('311) specifically teach that increasing the power of said laser results in an improved internal finish of said drilled hole, hence an improved product is obtained.

Furthermore, it should be noted that Temple *et al.* ('311) specifically teach maintaining the laser power low at the beginning of the drilling process in order to avoid damage due to exhaust products, hence teaching a similar two-step laser drilling process as WO 86/02301.

Regarding claims 13-15, WO 86/02301 teaches altering the pulse width, peak energy and duration such that delamination is avoided (see Abstract and page 6, lines 20-25). Therefore, it would have been obvious for one of ordinary skill in the art to have altered the pulse width, peak energy and duration for a second train of higher power pulses as compared to a first train of laser pulses taught by WO 86/02301 to drill and trim said hole as taught by Temple *et al.* ('311) in the process of Ayrton ('456) because, WO 86/02301 specifically teaches that low-powered laser pulses avoid delamination of said multi-layered sheet, whereas Temple *et al.* ('311) specifically teach that altering the power of said laser results in an improved internal finish of said drilled hole, hence an improved product is obtained. It is submitted that when a laser pulse is not applied to the multi-layered material, then the energy of a previously applied laser pulse is being dissipated into said multi-layered material, thereby allowing time for energy to dissipate and hence, avoid delamination of said multi-layered material.

4. Claims 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 86/02301 in view of Temple *et al.* (US Patent No. 6,228,311 B1).

WO 86/02301 teaches the basic claimed process of laser drilling a multi-layer sheet by providing a train of low-powered laser pulses to drill through said multi-layered sheet, said low powered pulses preventing delamination, and after said multi-layered sheet has been drilled, higher power pulses are employed. It is submitted that since delamination is avoided, that the

resulting inter-layer pull-off force is smaller than an inter-layer adhesion force (see Abstract and page 6, line 4 through page 7, line 14). It is submitted that a train of laser pulses includes a plurality of individual laser pulses, hence at least one pulse.

Regarding claim 12, although WO 86/02301 teaches a second train of high-powered pulses WO 86/02301 does not teach trimming said drilled hole using a second train of high-powered laser pulses. Temple *et al.* ('311) teach laser drilling a hole in which the laser power is increased at the end of the drilling process in order to trim the final shape of said drilled hole (see col. 7, lines 1-11). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a second train of high-power pulses to trim said drilled hole as taught by Temple *et al.* ('311) in the process of WO 86/02301 because, Temple *et al.* ('311) specifically teach that increasing the power of said laser results in an improved internal finish of said drilled hole, hence an improved product is obtained. Furthermore, it should be noted that Temple *et al.* ('311) specifically teach maintaining the laser power low at the beginning of the drilling process in order to avoid damage due to exhaust products, hence both references teaching a similar two-step laser drilling process.

In regard claim 13-14, WO 86/02301 teaches altering the pulse width, peak energy and pulse duration (see Abstract and page 6, lines 20-25). Since the pulse duration is being controlled, it is submitted that the time between pulses is also controlled. Further, it is submitted that when a laser pulse is not applied to the multi-layered material, then the energy of a previously applied laser pulse is being dissipated into said multi-layered material, thereby

allowing time for energy to dissipate and hence, avoid delamination of said multi-layered material.

Allowable Subject Matter

5. Claims 1-3 are allowed.

6. The following is an examiner's statement of reasons for allowance: the prior art does not teach or suggest a method for laser drilling a hole in a multi-layered sheet material including, drilling said hole through all the layers of the sheet using at least one laser pulse having a first energy such that an inter-layer pull-off force is smaller than an inter-layer adhesion force and, trimming the shape of said hole by at least one laser pulse having a second energy level higher than said first energy level, wherein a time interval of approximately 200 μs exists between said drilling by at least one pulse at said first energy level and said trimming by at least one energy pulse at said second energy level.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

7. Applicants' arguments filed November 10, 2004 have been considered.

7. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Ayrton ('456) teaches a process for drilling a hole in a multi-layered sheet using a laser without delamination of said multi-layered sheet occurring (see col. 2, line 53 through col. 3, line 18). It is submitted that since delamination is avoided, that the resulting inter-layer pull-off force is smaller than an inter-layer adhesion force.WO 86/02301 teaches a process for laser drilling a multi-layer sheet by providing a train of low-powered laser pulses to drill through said multi-layered sheet, said low powered pulses preventing delamination, and after said multi-layered sheet has been drilled, higher power pulses are employed. It is submitted that since delamination is avoided, that the resulting inter-layer pull-off force is smaller than an inter-layer adhesion force (see Abstract and page 6, line 4 through page 7, line 14). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a first train of low-powered laser pulses to drill a hole in a multilayered-sheet as taught by WO 86/02301 in the

process of Ayrton ('456), because WO 86/02301 specifically teaches that low-powered laser pulses avoid delamination of said multi-layered sheet, whereas Ayrton ('456) teaches laser drilling in a multi-layered sheet while avoiding delamination of said multi-layered sheet, hence both references solving the similar problem of delamination of a multi-layered sheet while drilling holes therein. Further, Temple *et al.* ('311) teach laser drilling a hole in which the laser power is increased at the end of the drilling process in order to trim the final shape of said drilled hole (see col. 7, lines 1-11). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a second train of higher power pulses as taught by WO 86/02301 to trim said drilled hole as taught by Temple *et al.* ('311) in the process of Ayrton ('456) because, Temple *et al.* ('311) specifically teach that increasing the power of said laser results in an improved internal finish of said drilled hole, hence an improved product is obtained. Furthermore, it should be noted that Temple *et al.* ('311) specifically teach maintaining the laser power low at the beginning of the drilling process in order to avoid damage due to exhaust products, hence teaching a similar two-step laser drilling process as WO 86/02301.

Applicants argue that because "Ayrton specifically discloses that, due to the formation and/or structure of his carbon fiber layer, no delamination, bursting, or blistering occurs when a hole is drilled," then "there is no motivation to modify Ayrton with Zahaykevich's teaching such that low-powered pulses are used to drill the hole, since the formation and/or structure of Ayrton's multi-layered sheet eliminates the problem of delamination" (see page 6 of the amendment filed November 10, 2004). In response, it is noted that the teachings of Ayrton ('456) are limited to a panel having a specific thickness of 1 mm, a given number of eight layers of

unidirectional carbon fibers having a specific orientation and, a specific resin to fiber ratio. Hence, it is submitted that if such parameters are changed then another solution to delamination is required as taught by WO 86/02301. Further, it is noted that the teachings of WO 86/02301 provide for an improved solution to delamination. Furthermore, it is noted that under MPEP §2144, "the rationale [to combine] may be expressly or impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art, established scientific principles, or legal precedent established by prior case law. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Therefore, it would have been obvious for one of ordinary skill in the art to have provided a first train of low-powered laser pulses to drill a hole in a multi-layered sheet as taught by WO 86/02301 in the process of Ayrton ('456), because WO 86/02301 specifically teaches that low-powered laser pulses avoid delamination of said multi-layered sheet, whereas Ayrton ('456) teaches laser drilling in a multi-layered sheet while avoiding delamination of said multi-layered sheet, hence both references solving the similar problem of delamination of a multi-layered sheet while drilling holes therein, hence providing a solution for laser drilling holes in a multi-layered sheet of any configuration.

Applicants argue that because, "Zahaykevich discloses that low-power pulses are used to begin the drilling, the power is increased towards the middle of the drilling, and then reduced towards the end of the drilling... Zahaykevich does not disclose or suggest, inter alia, the claimed feature of drilling through all layers by at least one laser pulse having a first energy" (see page 7 of the amendment filed November 10, 2004). In response, it is noted that under

MPEP §2111.03, "[T]he transitional term "comprising", which is synonymous with "including," "containing," or "characterized by," is inclusive or open-ended and does not exclude additional, unrecited elements or method steps. See, e.g., Invitrogen Corp. v. Biocrest Mfg., L.P., 327 F.3d 1364, 1368, 66 USPQ2d 1631, 1634 (Fed. Cir. 2003). Hence, the process of WO 86/02301 in view of Temple *et al.* ('311) includes "at least one laser pulse having a first energy."

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stefan Staicovici, Ph.D. whose telephone number is (571) 272-1208. The examiner can normally be reached on Monday-Friday 9:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael P. Colaianni, can be reached on (571) 272-1196. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Stefan Staicovici, PhD

Stefan Staicovici 1/12/05

Primary Examiner

AU 1732

January 12, 2004